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Memory of Things (*M*oT)

Interactive old things memory system for the senior's Reminiscence

1. Background and Objective of the Study

Most home-based technology-aided products that are currently available on the market are designed for the needs of seniors. The design emphasis is often on the technology itself, instead of its ease of use, thus leading to poor acceptance by users. More attention should be given to the interaction between "people" and "things" and the product's usability. In recent years, Ecological approach and Affordance, proposed by the psychologist Gibson, for the design of technology-based interactive products have gradually received more attention in Computer-Human Interface design (Gibson, 1999; Murphy, 1999). Moreover, emotions may be generated because of engagement, usage or events between people and people, people and things, and people and space. Memory is eventually generated when time is factored in. The well-known psychologists Mihaly Csikszentmihalyi and Eugene Rochberg-Halton (1981) note in their book *The Meaning of Things,* that people like certain things in their life because of their connection to their memory. The authors reach this conclusion using a theory of Psychology and analytical tools that are used in sociology. A special story gives a thing a significant meaning, thus making it emotionally attractive, triggering one's sentiment to the past, to make connection to memorize.

"Home" is the origin of human memory. "Things" in life become the carrier of memories throughout life. Unfortunately most of the technology-aided design cases still put too much emphasis on technology and not enough on the more human aspects, such as emotion and memory. In fact, the "memory of life" has stronger and special significance for seniors because physiologically speaking, seniors' short-term memory weakens gradually over time while their long-term memory grows stronger by comparison. Psychologically speaking, seniors develop a sense of loss because they have an awareness of the end of life and thus lose interest and faith in the future. As a result, they begin to voluntarily remember their life stories and arouse their sentiment for the past. As a promoter of narrative research, American researcher McAdam believes that each senior's "story of life" is an important unfolding memory that the individual experiences and is an interpretation of such an experience. If the senior is given the opportunity to narrate their own life story, the caregiver can easily and clearly understand the needs of the senior and provide better assistance and care.

In conclusion, several questions should be considered in elderly design: (1) how should the technology-aid interactive product be designed to enable the senior to accept

and adapt to the product? and (2) what requirements should the interactive product design meet to cope with the seniors' habits for interaction and cognition in daily life? With these questions in mind, this study intends to emphasize seniors' interactions with people, things, and the environment on the basis of the above-mentioned psychological theory. The things in daily life, which contain a rich "memory of life," should already be familiar to the senior. With these things, as well as enhancements in emotion, memory, and narration, an interactive product design with better adaptation for the senior can then be provided with the help of the Internet and technology.

2. Literature review

Most technology-aided products are designed with technology or functionality as the major emphasis. Very few focus on aspects of the human experience or human perspectives, such as memory. This study provides several case studies that have "memory" as the major element in the design of the technology-aided product, as presented below:

CASE 01: "The Memory Box" in the study of Frohlich and Murphy (2000). A jewelry box is used as the recording tool for oral narration. The user's story is recorded when it is told orally. The recorded story may be played back later. Among all subjects, children and female subjects were most interested in this tool. In particular, children even used it to orally record their daily life story as a diary.

CASE02: In their "The Living Memory Box" project, Stevens et al. (2003) record events by recording the sound and appearance of physical objects, with other recording methods. It is concluded that the recoding must be performed in a more natural way to be effective. Sound and touchable objects as the recording media can better motivate the subjects to record their story.

CASE03: The University College of London collaborated with five universities and launched a project called "Tales of Things and Electronic Memory" (TOTeM). This project was dedicated to promote "Tales of Things" by encouraging people to upload photos of the appearance of physical objects and the relevant memories associated with them, in the form of text, sound, or images, to the website at www.talesofthings.com. The 2D bar code, or specially RFID labels, corresponding to the uploads were affixed to the objects while the object was given a label to be tagged on the network map. These bar codes and labels can facilitate better understanding by future generations of the history of the objects because this project provides a new way of preserving social memory.

3. Research method

Based on the Research-through-design approach (John Zimmerman, 2007), a product design approach is proposed that is better adapted to seniors. Meanwhile, subjects, such as the enhancement of the memory of life through old things, are studied to help establish an emotional relationship between the senior and other people and between the senior and their family.

Step 1 Data Analysis: Thirty seniors between the age 50 and 90 were surveyed and interviewed for the collection of (old) things of life and relevant stories that triggered the senior's emotion for "home." In this step, children or grandchildren of the senior interviewed the senior and recorded the results. Habits developed over time and cognition of daily life were understood through the insight gained from close involvement with the senior's life. It is particularly important to allow the senior tell their story of the old things or their own memories. The recordings were then organized in the format required by the questionnaire. In addition to text, sound and photos were also recorded.

Step 2 Design Concept: This step began by taking materials from the interview data and background stories and continued the development of design guidelines, design ideas, interaction scenarios, and drafting. The development of design guideline included the effort of organizing and choosing old things in Step 1, plus adding technology-aided functionality, interaction mechanisms, and so on. Once done, the collection of relevant old things then began in preparation of prototyping interactive design in Step 3.

Step 3 Information Framework: Based on the information framework "Body-Cerebellar-Brain"[note 1] and the *Whiz*CARPET sensor pad as activity sensors, both developed by the Gerontechnology Research Center, Yuan Ze University, the customized interaction design may be achieved through an APP with user-adaptable parameters. In the meantime, social network sites such as Facebook are included the interaction platform.

Step 4 Design Prototype: Digital fabrication techniques, such as 3D printing, laser cutting, 3D scanning, and CNC milling, are employed for the customized repair of the old things of life and replacing damaged parts. Further, with the addition of interactive devices, such as control chips, sensors, and so on, not only can the objects function according to their original purposes but also provide adaptive technology-aided interactive functions.

Note 1: The system "Body-Cerebellar-Brain" consists of hardware (Body), a controller (Cerebellar) and a mobile device (Brain). The mobile application is the "Brain," providing users with various features for data entry and displaying information; the interaction device that employs a micro-processor as its controller is the "Cerebellar", which handles the operation of algorithm and basic I/O signal control and is responsible for motor control and signal feedback. The device itself is the hardware, which is named the "Body."

4. Design Principles

This study proposes that the project be named “Memory of Things (MoT) – Interactive old things memory system” for the senior's Reminiscence activity. This memory system design guideline is as follows:

1. **Do not re-design a new thing, but repair the old things in home**. First repair the old or damaged things that the senior is familiar with. Then, add to the repaired object technology-aided interaction functions. Adhere to the principle of "bringing an old thing to new life," but avoid damage to the original features of the old things.
2. **Choose the things that belong to the "home" and leave unforgettable memories** or those that are rich in the story of life. Things in this category include magnets on the refrigerator, photo albums, clip book (newspaper clippings, ticket stubs), diary, letters, jewelry box, gift ornaments, souvenir (from travel), first purchased objects (for wedding, new-born), old sofa, old electric fan, old TV, sewing machine, phonograph, radio, old cars, and so on.
3. Understand the background story of the senior and **provide customized product design**.
4. **Provide a carrier of memory.** The collection and organization of emotional attachment between the senior and their children ach is achieved through the interactive product and the social network (Facebook) that aims to bring intimacy. An **individualized family "story network"** is established with the hope of facilitating a cross-generation communication that is rooted in "showing concern for others in daily life". The product that contains sentiment for the past thus becomes a memory carrier.
5. **Provide an interaction mechanism for "Environment, Things, and People."** Design an interactive product that links the environment, the things and the senior in daily home activity.

5. Interactive Scenario

Based on the interviewed data in Step 1 (Figure X), the vintage fan and lamp are selected as the products example of the interactive design system. The interactive scenarios are described as follows:

A. <u>Sensing activities and environment/ Recording memories</u>

Interactive vintage fan

Sensors: *Whiz*CARPET (location)
*Whiz*CUSION (sofa, amount of visitors)

Actions: Turn on (temperature sensor) automatically
Adjust speed automatically (according to temperature)
Playing music (alone)
Recording story (visitors)

- **Approaching living room**: Figure 1 (top) shows that when the senior enters a specific space, for example living room, the *Whiz*CARPET sensor pad senses the movement and automatically turns the fan on. The Micro-controller (Arduino YUN) on the fan starts reading the input value from the temperature sensor, and controls the output motor to adjust the speed of the fan automatically according to the temperature value.
- **Sitting alone**: As Figure 1 (middle) shown, when the senior sits on the chair or sofa alone, the *Whiz*CUSION sensor pad on the chair or sofa sends the data of sitting time to the Cloud, and The Micro-controller (Arduino YUN) on the fan will retrieve the data, then automatically plays the music on.
- **Sitting and chatting with friends**: As Figure 1 (bottom) shown, when an old friend of the senior visits and chats with him or her and they are sitting together on the sofa, both begin to talk about a common memory or tell a story about the vintage fan when they see it. The *whiz*CUSION sensor pads on the sofa senses the visitor and sends the data to the Cloud. Additionally, the recording device on the electric fan turns on and stores the conversation for to preserve the memory when it senses a gathering of multiple people.

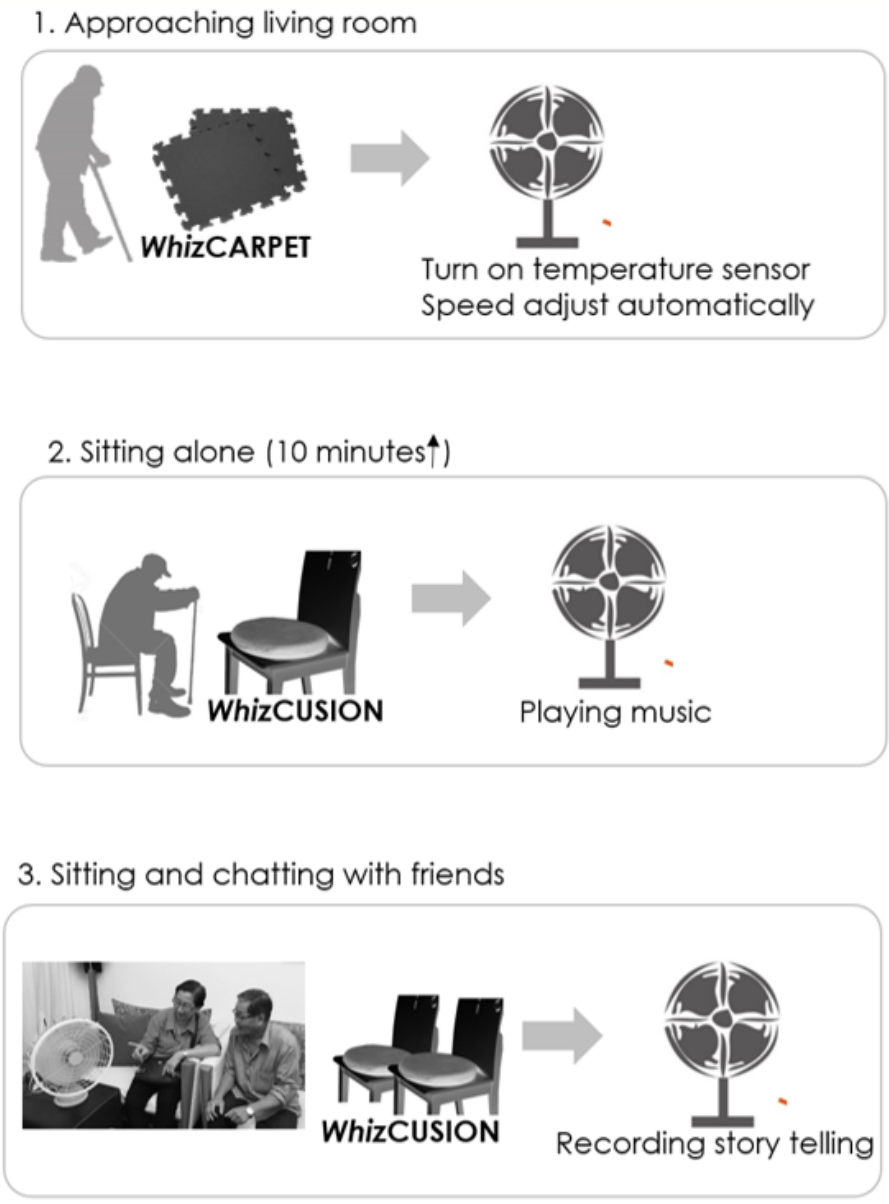

Figure 1: The interactive scenario of vintage fan

- The temperature and the sitting period can be adjusted through APP directly for individualization purposes (Figure 2).

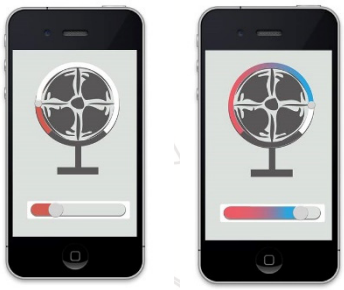

Figure 2: The APP for personalize control

Interactive lamp

Sensors: *Whiz*CARPET (location)
*Whiz*CUSION (Sitting/ Reading in front of the desk)
*Whiz*PAD (Sleeping on the bed)

Actions: Turn on (light sensor) automatically
Normal Mode (Adjust light intensity automatically)
Reading Mode (Rotate lampshad)
Sleeping Mode (Rotate lampshad)
Recording Mode (Lithophane lampshad, voice diary)

- **Approaching bedroom**: Figure 3 (top) shows that when the senior enters to their bedroom, the *Whiz*CARPET sensor pad senses the movement and automatically turns the lamp on. The Micro-controller (Arduino YUN) on the lamp starts reading the input value from the light sensor, and controls the LED to adjust the lightness of the lamp automatically according to the luminosity value.
- **Sitting in front of the desk**: As Figure 3 (middle 1) shown, when the senior sits on the chair in front of the desk, the *Whiz*CUSION sensor pad on the chair sends the data of sitting value to the Cloud, and The Micro-controller (Arduino YUN) on the lamp will retrieve the data, then automatically controls the motor to adjusts the angle of lampshade and brightness of LED, for the "Reading Mode".
- **Sleeping on the bed**: As Figure 3 (middle 2) shown, when the senior sleeping on the bed, the *Whiz*PAD (same as *Whiz*CUSION but larger size pad) sensor pad on the bed sends the data to the Cloud, and after The Micro-controller (Arduino YUN) on the lamp retrieve the data, it controls the motor to adjusts the angle of lampshade and brightness of LED, for the "Sleeping Mode".
- **Looking at old photos (lithophane lampshade)**: Figure 3 (bottom) shows that when the senior sits on the chair in front of the desk, and starts looking at old photos in album or the lithophane lampshade, they can push the "record button" on the lamp to record their voice diary or daily life stories. The Micro-controller (Arduino YUN) on the lamp will store the voice data and can be played back. All recorded data will be sent to the Cloud too.

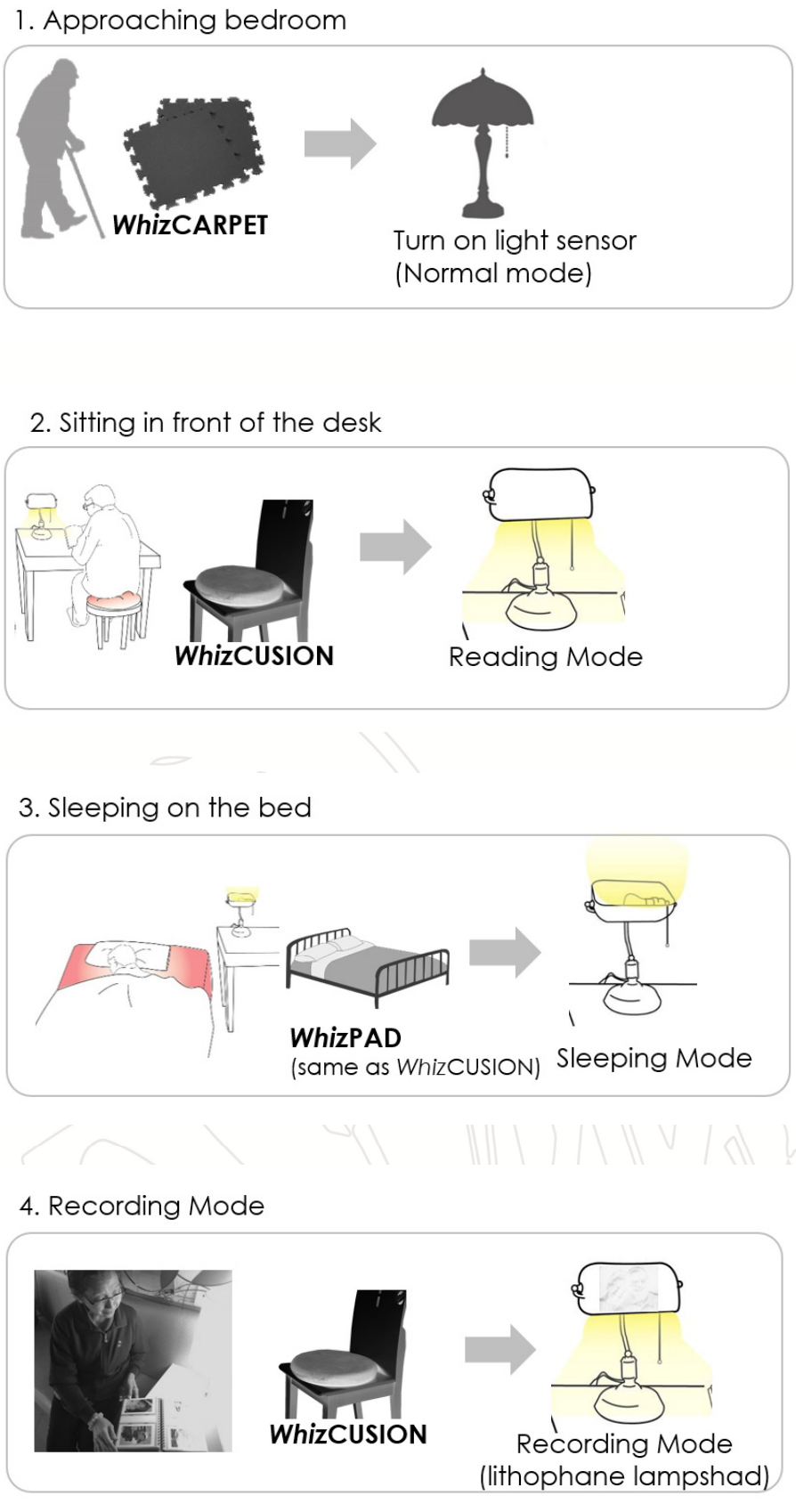

Figure 3: The interactive scenario of old lamp

B. Connecting of generations

The temperature or luminosity of the space, the senior's activity, and the recording of the stories are transmitted to the cloud storage of the information framework and to Facebook so that all may be shared with the family members or friends of the senior. The family members may respond (in the form of text or picture) on Facebook and print the photos kept in the house of the senior to the size of a post card for the senior's family album collection (Figure 4).

Figure 4: The FB status (with hashtag) triggers the printer in seniors' house

6. Design Prototype

This study collected the damaged vintage fan and old lamp from seniors and has been completely repaired by the aid of digital fabrication techniques. We reproduced parts on these old staff by scanning, modelling and then 3D printing. Some damaged parts were replaced by 3D printed parts and laser cut elements (Figure 5). Meanwhile, we embedded the Micro-controller (Arduino YUN), input devices (sensors, storage module), and output devices (speakers, motors, LEDs) on these old staff. Later we completed the electronic circuit and programing (Figure 6). Finally the vintage fan and old lamp connected to the internet via WIFI, to send and retrieve data. We did a lot of try and errors in the process of fabricating, circuit mounting and programing. Figure 7 shows the completed vintage fan and old lamp, it remain the same appearance but the functions already enhanced to adapt the seniors' daily life and extend to become an interactive memory system with the help of the Internet and technology.

Figure 5: Repairing process aided by digital fabrication techniques

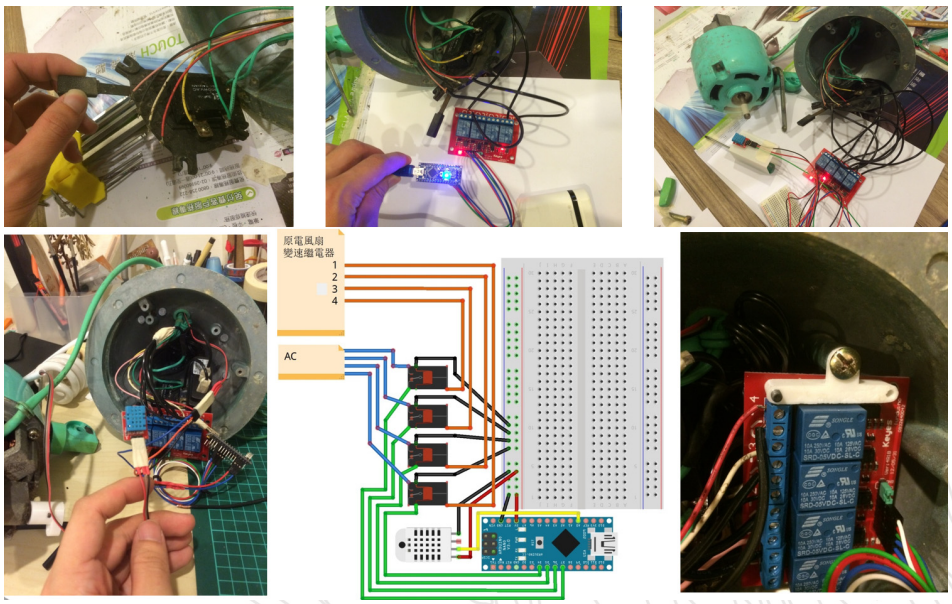

Figure 6: Embedded the micro-controller, circuit mounting and programing

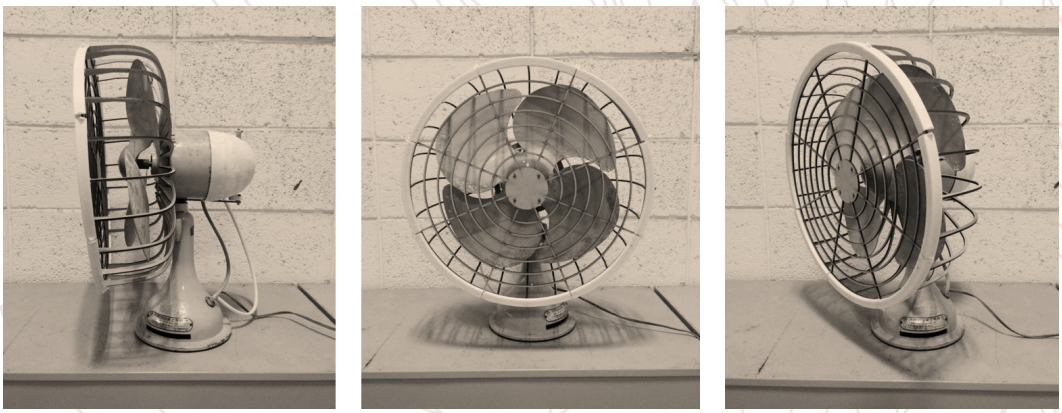

Figure 7: The completed vintage fan

7. Conclusion

The prototype of the interactive fan and lamp are completed in this study. It is hoped that the interaction mechanisms of "Environment, Things, and People" for individualized MoT may be applied to more things that trigger sentiment for the past, link more "memories of life", and allow the senior to recall, with the aid of technology, a richer and more full story of their life. Furthermore, this study concludes The MoT interactive mechanism information framework as shown in Figure 8. User test will be the next step of our research aim, and we will test these interactive old things in the living lab of Gerontechnology Research Center in Yuan Ze University.

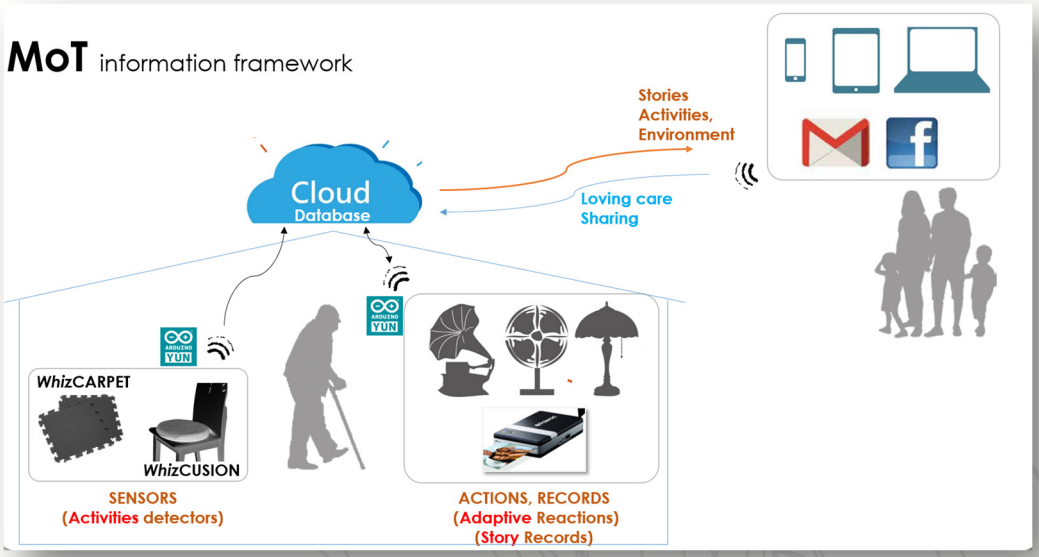

Figure 8: The MoT information structure

Reference

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